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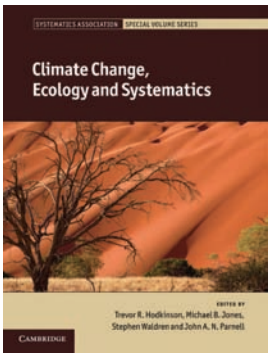
Systematics and climate change

Climate Change, Ecology and Systematics. The Systematics Association Special Volume 78. Trevor R. Hodkinson, Michael B. Jones, Stephen Waldren & John A. Parnell (editors), 2011, Cambridge University Press. 524 pp. £75 (hardback) ISBN: 978-0-521-76609-8; http://www.cambridge.org



Climate change, ecology and systematics reviews what the fields of ecology and taxonomy—the latter in its broad sense of 'systematics', which includes phylogenetics—have to offer to climate change science. The answer is: a great deal, especially the field of systematics, which is perhaps dealt with more prominently in the book than ecology. This emphasis is understandable because the book is the result of a symposium organised in 2008 under the auspices of the Systematics Association.

The volume of 21 chapters is divided into three principal sections: adaptation, speciation and extinction; biogeography, migration and ecological niche modelling; and conservation. The breadth of this book is a strength, but it does result in a veritable mixed bag of material, from wood anatomy and climate change, to the responses of terrestrial green algae to climate change, to the impact of climate change on ash trees. It is something to be dipped into, with the opening chapter by lead editor Trevor Hodkinson serving as a useful guide to which chapters a reader may wish to focus on. As a read from cover to cover, I did find it something of a marathon.

There are some excellent and rewarding chapters. For example, as a non-specialist in both areas, I found the reviews of deep time climate change (Caballero and Lynch) and the effects of climate change on lichen diversity (Ellis and Yahr) very useful. The chapter by McElwain and co-authors on the possible effects of long-term CO_2 fluctuations on plant speciation rates contains some stimulating ideas, for example that raised CO_2 levels directly increased plant speciation rates during the Eocene thermal maximum. Disentangling such putative effects from others suggested to have operated during this period (e.g. a species–area effect for tropical forest; Jaramillo et al., 2006) is, however, tricky. I also enjoyed the chapters using phylogenetic methods to understand the effects of climate change on diversification in both *Cyclamen* (Yesson and Culham) and African rain forest trees (Chatrou *et al*.).

The endeavours of systematic biologists worldwide over the past centuries have left a wealth of museum collections—in the UK, the Royal Botanic Gardens Kew and Edinburgh alone hold 10 million plant specimens—and the world's preserved plant collections (herbaria) are estimated to contain 350 million specimens, each giving information about occurrences of the plant species they represent. This is a huge and perhaps underutilised resource for understanding the distribution of organisms, and especially now for the modelling of species distributions under scenarios of climatic change. It is utilised in this book in several chapters, including that of Simpson *et al.*, who take advantage of the 120,000 sedge specimens held in the herbarium at the Royal Botanic Gardens, Kew, to explore the effects of future climatic changes on sedges (Cyperaceae).

In places, some chapters do appear to go somewhat off-piste, though they are, all the same, highly readable. Richard Bateman's diverse works are always stimulating, and his chapter here is a manifesto for a global change in taxonomic practice that really only touches upon links to climate change science. Hall and Miller outline new approaches to field plant identification guides; again the link to climate science is somewhat tenuous. Finally, Bernardo gives a review of cryptic evolutionary diversity (i.e. species that are deeply genetically distinct but lack obvious morphological differences), but the background given, though excellent, is very lengthy, and one only arrives (exhausted!) at the link to climate change after about 30 pages.

Set against these diversions, one could also

argue that there are some omissions in the volume that are highly relevant to climate change science. For example, the study of fossil pollen, which is at heart an enterprise of taxonomic identification, has told us a huge amount about how past climates have affected vegetation globally. However, of course, adding more material to the book might have made it unmanageably large for both the editors and readers.

Taxonomists sometimes feel hard done by in terms of the perception of the relevance and utility of their discipline (House of Lords, 2008) and the funding support that it receives. This may have been the driver for Richard Bateman's somewhat political offering in this book; at its time of publication, he was President of the Systematics Association, an organisation that is committed to furthering all aspects of systematic biology (http://www.systass.org). Books such as this help to explain clearly how systematics does more than stand on its own feet. They show that systematics is a vital foundation science, upon which urgent research of great relevance can be built in these times of human-driven climate change.

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